

SEQUENCE LISTING

In the following SEQ ID Nos. 1, 3, 5 the 5', coding sequence and 3' sequence of the relevant α -amylase genes are illustrated. The 5' sequence is the first separate part of the sequence written with lower case letters, the coding sequence is the intermediate part of the sequence, where the signal sequence is written with lower case letters and the sequence encoding the mature α -amylase is written with upper case letters, and the 3' sequence is the third separate part of the sequence written with lower case letters.

SEQ ID No. 1

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15 VQR

SEQ ID No. 3

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SEQ ID No. 5

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SEQ ID No. 10

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SEQUENCE LISTING

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 Borchert, Torben
 Bisgard-Frantzen, Henrik

<120> Alpha-Amylase Mutants

<130> 4796.234-US

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gatgtgatcg	gatggacgag	ggaaggtgac	agctccgcgc	ccaaatcagg	tttggccgct	1620
ttaatcacgg	acggacccgc	cggatcaaa	cggatgactg	ccggcctgaa	aatgccggc	1680
gagacatggt	atgacataac	gggcaaccgt	tcagatatac	taaaatcgg	atctgacggc	1740
tggggagagt	ttcatgtaaa	cgatgggtcc	gtctccattt	atgttcagaa	ataaggtaat	1800
aaaaaaacac	ctccaagctg	agtgcgggta	tcagcttgga	ggtagcttta	tttttccagc	1860
cgtatgacaa	ggtcggcatc	aggtgtgaca	aatacgggat	gctggctgtc	ataggtgaca	1920
aatccggggt	ttgcgcgctt	tggctttttc	acatgtctga	tttttgtata	atcaacaggc	1980
acggagccgg	aatctttcgc	cttggaaaaa	taagcggcga	tcgtagctgc	ttccaatatg	2040
gattgttcat	cgggatccgt	gcttttaata	acaacgtggg	atcc		2084

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<210> 4
<211> 480
<212> PRT
<213> Bacillus amyloliquefaciens
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Val Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Thr Pro Asn Asp
1 5 10 15

Gly Gln His Trp Lys Arg Leu Gln Asn Asp Ala Glu His Leu Ser Asp
 20 25 30
 Ile Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Tyr Lys Gly Leu Ser
 35 40 45
 Gln Ser Asp Asn Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp Leu Gly Glu
 50 55 60
 Phe Gln Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ser Glu
 65 70 75 80
 Leu Gln Asp Ala Ile Gly Ser Leu His Ser Arg Asn Val Gln Val Tyr
 85 90 95
 Gly Asp Val Val Leu Asn His Lys Ala Gly Ala Asp Ala Thr Glu Asp
 100 105 110
 Val Thr Ala Val Glu Val Asn Pro Ala Asn Arg Asn Gln Glu Thr Ser
 115 120 125
 Glu Glu Tyr Gln Ile Lys Ala Trp Thr Asp Phe Arg Phe Pro Gly Arg
 130 135 140
 Gly Asn Thr Tyr Ser Asp Phe Lys Trp His Trp Tyr His Phe Asp Gly
 145 150 155 160
 Ala Asp Trp Asp Glu Ser Arg Lys Ile Ser Arg Ile Phe Lys Phe Arg
 165 170 175
 Gly Glu Gly Lys Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn
 180 185 190
 Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Tyr Asp His Pro Asp Val
 195 200 205
 Val Ala Glu Thr Lys Lys Trp Gly Ile Trp Tyr Ala Asn Glu Leu Ser
 210 215 220
 Leu Asp Gly Phe Arg Ile Asp Ala Ala Lys His Ile Lys Phe Ser Phe
 225 230 235 240
 Leu Arg Asp Trp Val Gln Ala Val Arg Gln Ala Thr Gly Lys Glu Met
 245 250 255
 Phe Thr Val Ala Glu Tyr Trp Gln Asn Asn Ala Gly Lys Leu Glu Asn
 260 265 270
 Tyr Leu Asn Lys Thr Ser Phe Asn Gln Ser Val Phe Asp Val Pro Leu
 275 280 285
 His Phe Asn Leu Gln Ala Ala Ser Ser Gln Gly Gly Gly Tyr Asp Met
 290 295 300
 Arg Arg Leu Leu Asp Gly Thr Val Val Ser Arg His Pro Glu Lys Ala
 305 310 315 320
 Val Thr Phe Val Glu Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu
 325 330 335
 Ser Thr Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
 340 345 350
 Thr Arg Glu Ser Gly Tyr Pro Gln Val Phe Tyr Gly Asp Met Tyr Gly
 355 360 365
 Thr Lys Gly Thr Ser Pro Lys Glu Ile Pro Ser Leu Lys Asp Asn Ile
 370 375 380
 Glu Pro Ile Leu Lys Ala Arg Lys Glu Tyr Ala Tyr Gly Pro Gln His
 385 390 395 400
 Asp Tyr Ile Asp His Pro Asp Val Ile Gly Trp Thr Arg Glu Gly Asp
 405 410 415
 Ser Ser Ala Ala Lys Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
 420 425 430
 Gly Gly Ser Lys Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly Glu Thr
 435 440 445
 Trp Tyr Asp Ile Thr Gly Asn Arg Ser Asp Thr Val Lys Ile Gly Ser
 450 455 460
 Asp Gly Trp Gly Glu Phe His Val Asn Asp Gly Ser Val Ser Ile Tyr
 465 470 475 480

<210> 5
 <211> 1814
 <212> DNA
 <213> Bacillus stearothermophilus

<400> 5
aaattcgata ttgaaaacga ttacaaataa aaattataat agacgtaaac gttcgagggg 60
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tcgaatgtaa catttgatta agggggaagg gcattgtgct aacgtttcac cgcattcattc 180
gaaaaggatg gatgttcctg ctgcgctttt tgctcactgt ctgcgtgttc tgccaacag 240
gacagcccgc caaggctgcc gcaccgttta acggcaccat gatgcagtat tttgaatggt 300
acttgccgga tgatggcagc ttatggacca aagtggccaa tgaagccaac aacttatcca 360
gccttggcat caccgctctt tggctgccgc ccgcttataa aggaacaagc cgcagcgacg 420
tagggtagcg agtatacgac ttgtatgacc tcggcgaatt caatcaaaaa gggaccgtcc 480
gcacaaaata cggaaacaaa gctcaatata ttcaagccat tcaagccgcc cagccgctg 540
gaatgcaagt gtacgccgat gtcgtgttcg accataaagg cggcgctgac ggcacggaat 600
gggtggacgc cgtcgaagtc aatccgtccg accgcaacca agaaatctcg ggcacctatc 660
aaatccaagc atggacgaaa tttgattttc ccgggcgggg caacacctac tccagcttta 720
agtggcgctg gtaccatttt gacggcgctg attgggacga aagccgaaaa ttgagccgca 780
tttacaaatt ccgcggcatc ggcaaagcgt gggattggga agtagacacg gaaaacggaa 840
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tttataccgc ttccaaatca gggggcgcat ttgatatgcy cactgtaatg accaatactc 1200
tcatgaaaga tcaaccgaca ttggccgtca ccttcgttga taatcatgac accgaaccgc 1260
gccaaagcgt gcagtcattg gtcgacccat ggttcaaacc gttggcttac gcctttattc 1320
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ataacattcc ttcgctgaaa agcaaaatcg atccgctcct catcgcgcg caggattatg 1440
cttacggaac gcaacatgat tatcttgatc actccgacat catcggtggg acaagggaag 1500
ggggcactga aaaaccagga tccggactgg ccgcactgat caccgatggg ccgggagaaa 1560
gcaaatggat gtacgttggc aaacaacacg ctggaaaagt gttctatgac cttaccggca 1620
accggagtga caccgtcacc atcaacagtg atggatgggg ggaattcaaa gtcaatggcg 1680
gttcggtttc ggtttgggtt cctagaaaaa cgaccgtttc taccatcgct cggccgatca 1740
caaccgcacc gtggactggt gaattcgtcc gttggaccga accacggttg gtggcatggc 1800
cttgatgcct gcga 1814

<210> 6
<211> 514
<212> PRT
<213> *Bacillus stearothermophilus*

<400> 6
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Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn
20 25 30
Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
35 40 45
Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp
50 55 60
Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr
65 70 75 80
Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met
85 90 95
Gln Val Tyr Ala Asp Val Val Phe Asp His Lys Gly Gly Ala Asp Gly
100 105 110
Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn Gln
115 120 125
Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe
130 135 140
Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His
145 150 155 160
Phe Asp Gly Val Asp Trp Asp Glu Ser Arg Lys Leu Ser Arg Ile Tyr
165 170 175
Lys Phe Arg Gly Ile Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu

Ala Leu Gln Ser Trp Val Asp Pro Trp Phe Lys Pro Leu Ala Tyr Ala
 340 345 350
 Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp
 355 360 365
 Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile Pro Ser Leu Lys Ser Lys Ile
 370 375 380
 Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His
 385 390 395 400
 Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu Gly Gly
 405 410 415
 Thr Glu Lys Pro Gly Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro
 420 425 430
 Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly Lys Val
 435 440 445
 Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ser
 450 455 460
 Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly Ser Val Ser Val Trp
 465 470 475 480
 Val Pro Arg Lys Thr Thr Val Ser Thr Ile Ala Arg Pro Ile Thr Thr
 485 490 495
 Arg Pro Trp Thr Gly Glu Phe Val Arg Trp Thr Glu Pro Arg Leu Val
 500 505 510
 Ala Trp

<210> 7
 <211> 478
 <212> PRT
 <213> Bacillus licheniformis

<400> 7
 Ala Thr Pro Ala Asp Trp Arg Ser Gln Ser Ile Tyr Phe Leu Leu Thr
 1 5 10 15
 Asp Arg Phe Ala Arg Thr Asp Gly Ser Thr Thr Ala Thr Cys Asn Thr
 20 25 30
 Ala Asp Gln Lys Tyr Cys Gly Gly Thr Trp Gln Gly Ile Ile Asp Lys
 35 40 45
 Leu Asp Tyr Ile Gln Gly Met Gly Phe Thr Ala Ile Trp Ile Thr Pro
 50 55 60
 Val Thr Ala Gln Leu Pro Gln Thr Thr Ala Tyr Gly Asp Ala Tyr His
 65 70 75 80
 Gly Tyr Trp Gln Gln Asp Ile Tyr Ser Leu Asn Glu Asn Tyr Gly Thr
 85 90 95
 Ala Asp Asp Leu Lys Ala Leu Ser Ser Ala Leu His Glu Arg Gly Met
 100 105 110
 Tyr Leu Met Val Asp Val Val Ala Asn His Met Gly Tyr Asp Gly Ala
 115 120 125
 Gly Ser Ser Val Asp Tyr Ser Val Phe Lys Pro Phe Ser Ser Gln Asp
 130 135 140
 Tyr Phe His Pro Phe Cys Phe Ile Gln Asn Tyr Glu Asp Gln Thr Gln
 145 150 155 160
 Val Glu Asp Cys Trp Leu Gly Asp Asn Thr Val Ser Leu Pro Asp Leu
 165 170 175
 Asp Thr Thr Lys Asp Val Val Lys Asn Glu Trp Tyr Asp Trp Val Gly
 180 185 190
 Ser Leu Val Ser Asn Tyr Ser Ile Asp Gly Leu Arg Ile Asp Thr Val
 195 200 205
 Lys His Val Gln Lys Asp Phe Trp Pro Gly Tyr Asn Lys Ala Ala Gly
 210 215 220
 Val Tyr Cys Ile Gly Glu Val Leu Asp Gly Asp Pro Ala Tyr Thr Cys
 225 230 235 240
 Pro Tyr Gln Asn Val Met Asp Gly Val Leu Asn Tyr Pro Ile Tyr Tyr
 245 250 255

Pro Leu Leu Asn Ala Phe Lys Ser Thr Ser Gly Ser Met Asp Asp Leu
 260 265 270
 Tyr Asn Met Ile Asn Thr Val Lys Ser Asp Cys Pro Asp Ser Thr Leu
 275 280 285
 Leu Gly Thr Phe Val Glu Asn His Asp Asn Pro Arg Phe Ala Ser Tyr
 290 295 300
 Thr Asn Asp Ile Ala Leu Ala Lys Asn Val Ala Ala Phe Ile Ile Leu
 305 310 315 320
 Asn Asp Gly Ile Pro Ile Ile Tyr Ala Gly Gln Glu Gln His Tyr Ala
 325 330 335
 Gly Gly Asn Asp Pro Ala Asn Arg Glu Ala Thr Trp Leu Ser Gly Tyr
 340 345 350
 Pro Thr Asp Ser Glu Leu Tyr Lys Leu Ile Ala Ser Ala Asn Ala Ile
 355 360 365
 Arg Asn Tyr Ala Ile Ser Lys Asp Thr Gly Phe Val Thr Tyr Lys Asn
 370 375 380
 Trp Pro Ile Tyr Lys Asp Ile Thr Ile Ala Met Arg Lys Gly Thr
 385 390 395 400
 Asp Gly Ser Gln Ile Val Thr Ile Leu Ser Asn Lys Gly Ala Ser Gly
 405 410 415
 Asp Ser Tyr Thr Leu Ser Leu Ser Gly Ala Gly Tyr Thr Ala Gly Gln
 420 425 430
 Gln Leu Thr Glu Val Ile Gly Cys Thr Thr Val Thr Val Gly Ser Asp
 435 440 445
 Gly Asn Val Pro Val Pro Met Ala Gly Gly Leu Pro Arg Val Leu Tyr
 450 455 460
 Pro Thr Glu Lys Leu Ala Gly Ser Lys Ile Cys Ser Ser Ser
 465 470 475

<210> 8
 <211> 20
 <212> DNA
 <213> *Bacillus amyloliquefaciens*

<400> 8
 gacctgcagt caggcaacta 20

<210> 9
 <211> 20
 <212> DNA
 <213> *Bacillus amyloliquefaciens*

<400> 9
 tagagtcgac ctgcaggcat 20

<210> 10
 <211> 31
 <212> DNA
 <213> *Bacillus licheniformis*

<400> 10
 ggctgtaggc accgtagccc caatccgctt g 31

<210> 11
 <211> 36
 <212> DNA
 <213> *Bacillus licheniformis*

<400> 11
 ggctgtaggc accgtagccc caatcccatt ggctcg 36

<210> 12
 <211> 28

<212> DNA
 <213> Bacillus licheniformis

 <400> 12
 ctgtgactgg tgagtactca accaagtc 28

 <210> 13
 <211> 31
 <212> DNA
 <213> Bacillus licheniformis

 <400> 13
 ggtagtaggc accgtagccc tcatccgctt g 31

 <210> 14
 <211> 31
 <212> DNA
 <213> Bacillus licheniformis

 <400> 14
 ggtagtaggc accgtagccc atatccgctt g 31

 <210> 15
 <211> 31
 <212> DNA
 <213> Bacillus licheniformis

 <400> 15
 ggtagtaggc accgtagcca atatccgctt g 31

 <210> 16
 <211> 36
 <212> DNA
 <213> Bacillus licheniformis

 <400> 16
 gcagcatgga actgctyatg aagaggcacg tcaaac 36

 <210> 17
 <211> 30
 <212> DNA
 <213> Bacillus licheniformis

 <400> 17
 catagttgcc gaattcattg gaaacttccc 30

 <210> 18
 <211> 34
 <212> DNA
 <213> Bacillus licheniformis

 <400> 18
 catagttgcc gaattcaggg gaaacttccc aatc 34

 <210> 19
 <211> 41
 <212> DNA
 <213> Bacillus licheniformis

 <400> 19
 ccgcgccccg ggaaatcaaa ttttgtccag gctttaatta g 41

 <210> 20

<211> 32
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 20
 caaaatggta ccaataccac ttaaaatcgc tg 32

 <210> 21
 <211> 29
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 21
 cttccaatc ccaagtcttc cttgaaac 29

 <210> 22
 <211> 36
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 22
 cttaatttct gctacgacgt caggatggtc ataac 36

 <210> 23
 <211> 38
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 23
 cgcccaagtc attcgaccag tactcagcta ccgtaaac 38

 <210> 24
 <211> 29
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 24
 gccgttttca ttgtcgactt cccaatccc 29

 <210> 25
 <211> 35
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 25
 ggaatttcgc gctgactagt cccgtacata tcccc 35

 <210> 26
 <211> 36
 <212> DNA
 <213> *Bacillus licheniformis*

 <400> 26
 ggcaggaatt tcgcgacctt tcgtcccgtacatc 36

 <210> 27
 <211> 36
 <212> DNA
 <213> *Bacillus amyloliquefaciens*

 <400> 27
 cctcattctg cagcagcagc cgtaaatggc acgctg 36

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<210> 28
<211> 38
<212> DNA
<213> Bacillus amyloliquefaciens

<400> 28
ccagacggca gtaataccga tatccgataa atgttccg 38

<210> 29
<211> 30
<212> DNA
<213> Bacillus amyloliquefaciens

<400> 29
cggatatcgg tattactgcc gtctggattc 30

<210> 30
<211> 21
<212> DNA
<213> Bacillus amyloliquefaciens

<400> 30
ctcgtcccaa tcggttccgt c 21

<210> 31
<211> 75
<212> DNA
<213> Bacillus licheniformis

<400> 31
cgcggcagca catacagcga ttwtvawtgg drttggwmt y attttgacgg aamcgattgg 60
gacgagtccc gaaag 75

<210> 32
<211> 84
<212> DNA
<213> Bacillus licheniformis

<400> 32
ctgaaccgca tctataagtt tmakrstaag rmktgggatw sggakgttav tmmtgaathk 60
rskaaactatg attatttgat gtat 84

<210> 33
<211> 72
<212> DNA
<213> Bacillus licheniformis

<220>
<221> misc_feature
<222> (0)...(0)
<223> N at 37 is 81% G, 7% A, 7% T, 5% C

<400> 33
tatgccgaca tcgattatga cyrthctdmw vttrwrnmts akwtwaramr atgggggcact 60
tggtatgcc a 72

<210> 34
<211> 78
<212> DNA
<213> Bacillus licheniformis

<220>
<221> misc_feature

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<222> (0)...(0)
<223> N at 31 is 93% C, 2% T, 2% A, 3% G

<400> 34
ttggacgggt tccgtcttga tdytgytaaa nwwmttargt wtwmttwtht wmvggawtgg 60
gttaatcatg tcagggaa 78

<210> 35
<211> 63
<212> DNA
<213> Bacillus licheniformis

<400> 35
gctgaccgca accgcgtaat ttcarskgak hhtwbawtaa rggcctggac acattttcat 60
ttt 63

<210> 36
<211> 78
<212> DNA
<213> Bacillus licheniformis
<400> 36
tggtaccatt ttgacggaac cgattggrak gagdcgcgaa rgmwaavtar gdwytwtaag 60
tttcaaggaa aggcttgg 78

<210> 37
<211> 93
<212> DNA
<213> Bacillus licheniformis

<220>
<221> misc_feature
<222> (0)...(0)
<223> N at 43 is 81% G, 8% T, 3% C

<400> 37
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avcargacar attttaatca ttcagtgttt gac 93

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